IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of	:	Attorney Docket No. 2006_1570A
Pascal DAGUIER et al.	:	**Confirmation No. 2691**
Serial No. 10/593,463	:	Group Art Unit 1793
Filed September 19, 2006	:	Examiner Mark L. Shevin
STEEL FOR MECHANICAL PARTS, METHOD FOR PRODUCING MECHANICAL PARTS FROM SAID STEEL AND THE THUS OBTAINABLE MECHANICAL PARTS	:	**Mail Stop: APPEAL BRIEFS-PATENTS**

APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The following is Appellants' brief, submitted under the provisions of 37 CFR 41.37, the time period for submission having been extended by one-month to March 6, 2011. Pursuant to the provisions of 37 CFR 41.20, this Brief is submitted with a fee of $540.

REAL PARTY IN INTEREST

The real party in interest is ASCOMETAL of Courbevoie, France, the assignee of record.

RELATED APPEALS AND INTERFERENCES

None.

STATUS OF THE CLAIMS

Claims 1-4 stand finally rejected.

Claims 5-8 have been cancelled.

Appellants appeal the rejection of claim 1-4.

STATUS OF THE AMENDMENTS

No Amendment has been filed subsequent to the issuance of the Final Office Action dated July 23, 2010 in which the rejection of claims 1-4 was made final.

SUMMARY OF THE CLAIMED SUBJECT MATTER

A description of the subject matter of the rejected claims is presented below with reference to the written description and drawings of this application. It is noted that the following descriptions are made with reference to the specification as originally filed.

The subject matter of independent claim 1 is drawn to steel for mechanical components (*See* Specification at page 5, lines 24-26), wherein the composition thereof is, in percentages by weight: $0.19\% \leq C \leq 0.25\%$ (*See* Specification at page 8, lines 11-20); $1.1\% \leq Mn \leq 1.5\%$ (*See* Specification at page 8, line 22 - page 9, line 2); $0.8\% \leq Si \leq 1.2\%$ (*See* Specification at page 9, lines 4-16); $0.01\% \leq S \leq 0.09\%$ (*See* Specification at page 9, lines 18-22); trace levels $\leq P \leq 0.025\%$ (*See* Specification at page 9, lines 24-31); trace levels $\leq Ni \leq 0.25\%$ (*See* Specification at page 10, lines 1-7); $1\% \leq Cr \leq 1.4\%$ (*See* Specification at page 10, lines 9-16); $0.10\% \leq Mo \leq 0.25\%$ (*See* Specification at page 10, lines 18-21); trace levels $\leq Cu \leq 0.30\%$ (*See* Specification at page 10, lines 23-30); $0.010\% \leq Al \leq 0.045\%$ (*See* Specification at page 10, line 32 - page 11, line 30); $0.010\% \leq Nb \leq 0.045\%$ (*See* Specification at page 10, line 32 - page 11, line 20 and page 11, line 32 - page 12, line 6); $0.0130\% \leq N \leq 0.0300\%$ (*See* Specification at page 10, line

32 - page 11, line 20 and page 12 line 8- line 12); optionally trace levels $\leq$ Bi $\leq$ 0.10% (*See* Specification at page 12, lines 14-20) and/or trace levels $\leq$ Pb $\leq$ 0.12% (*See* Specification at page 12, lines 14-20) and/or trace levels $\leq$ Te $\leq$ 0.015% (*See* Specification at page 12, lines 14-20) and/or trace levels $\leq$ Se $\leq$ 0.030% (*See* Specification at page 12, lines 14-20) and/or trace levels $\leq$ Ca $\leq$ 0.0050% (*See* Specification at page 12, lines 14-20); the balance being iron and impurities resulting from the production operation (*See* Specification at page 12, lines 22-32), the chemical composition being adjusted so that mean values J_{3m}, J_{11m}, J_{15m} and J_{25m} for five Jominy tests are such that: $\alpha = | J_{11m} - J_{3m} \times 14/22 - J_{25m} \times 8/22 | \leq 2.5$ HRC (*See* Specification at page 6, lines 22-32); and $ß = J_{3m} - J_{15m} \leq 9$ HRC (*See* Specification at page 6, lines 22-32).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-4 were rejected under 35 U.S.C. 103(a) as being unpatentable over Badard (WO 03/012156 - Full English Translation).

ARGUMENT

I. Rejection of claims 1-4 under 35 U.S.C. 103(a) as being unpatentable over Badard (WO 03/012156 - Full English Translation).

Claim 1 recites steel for mechanical components, wherein the composition thereof is, in percentages by weight: 0.19% $\leq$ C $\leq$ 0.25%; 1.1% $\leq$ Mn $\leq$ 1.5%; 0.8% $\leq$ Si $\leq$ 1.2%; 0.01 $\leq$ S $\leq$ 0.09%; trace levels $\leq$ P $\leq$ 0.025%; trace levels $\leq$ Ni $\leq$ 0.25%; 1% $\leq$ Cr $\leq$ 1.4%; 0.10% $\leq$ Mo $\leq$ 0.25%; trace levels $\leq$ Cu $\leq$ 0.30%; 0.010% $\leq$ Al $\leq$ 0.045%; 0.010% $\leq$ Nb $\leq$ 0.045%; 0.0130% $\leq$ N $\leq$ 0.0300%; and optionally trace levels $\leq$ Bi $\leq$ 0.10% and/or trace levels $\leq$ Pb $\leq$ 0.12% and/or trace levels $\leq$ Te $\leq$ 0.015% and/or trace levels $\leq$ Se $\leq$ 0.030% and/or trace levels $\leq$ Ca $\leq$ 0.0050%.

Appellants acknowledge that ranges of certain elements of the claimed steel composition lie within corresponding ranges disclosed by Badard. However, Appellants respectfully submit that the particular ranges of claim 1 achieve unexpected results relative to the broader prior art ranges taught by Badard.

MPEP 2144.05(I) states that a prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a *prima facie* case of obviousness. However, MPEP 2144.05 (III) provides that an applicant can rebut a *prima facie* case of obviousness by showing that the claimed invention achieves new and unexpected results relative to the prior art. To establish unexpected results over a claimed range, an applicant should compare a sufficient number of tests both inside and outside the claimed range to show the criticality of the claimed range (MPEP 716.02(d)(II))).

1. Unexpected Results Achieved by the Presently Claimed Invention

Appellants note that a Jominy curve of a steel is produced using a conventional standardized test and illustrates the quenchability of the steel (Specification, page 6). In particular, a Jominy curve is produced by measuring the hardness of a cylindrical test piece which has been quenched using a jet of water for spraying one of the ends of the test piece. The hardness is measured at several distances from the sprayed end, and the corresponding value is designated as J_x, where x is the distance from the sprayed end.

Appellants note that the selection of the content of the alloy elements of the presently claimed invention is intended to achieve a Jominy curve with no significantly marked inflection point, in which an inflection point is defined as a point on a curve where the concavity of the curve changes from a positive to a negative value or vice versa. (*See* Specification, page 6).

In this regard, Appellants respectfully submit that the presently claimed invention achieves the unexpected result of a composition of steel which produces a Jominy curve with no inflection point, and that such claimed composition of steel is advantageous for producing greatly reduced deformation during the quenching operation following a carburizing or carbonitriding operation.

Additionally, Appellants note that since a Jominy curve is based upon measurements of the hardness of a material at different depths of the material, it follows that an element that has an influence on the value of the hardness of a material would have an influence on the shape of the Jominy curve for the material. With regard to steel, Appellants respectfully submit that the

above is particularly true since a Jominy curve for steel would result from the combination of the influences of the various elements present in the steel. Of course, each of the various elements has a different quantitative influence on the hardness value, and as a result, modifying the contents of some of the elements simultaneously has an influence on the shape of the Jominy curve.

2. Evidence of the Criticality of the Claimed Ranges

(i) The Specification Provides Evidence of Criticality of the Claimed Ranges

Appellants respectfully submit that the specification provides ample support for the criticality of the narrower claimed ranges of claim 1 relative to the cited Badard reference.

In this regard, the steel composition according to Badard discloses the carbon content to be between 0.12% and 0.30%, i.e., $0.12\% \leq C \leq 0.30\%$ (Abstract). It is noted that the carbon content required by claim 1 lies between 0.19% and 0.25%, i.e., $0.19\% \leq C \leq 0.25\%$. As such, claim 1 requires a narrower range than that disclosed by the Badard reference. Appellants note that the specification discloses the criticality of the narrower claimed range of $0.19\% \leq C \leq 0.25\%$ by stating:

> "Furthermore, this range allows the contents of the other elements to be adjusted, which allows the desired shape to be produced for the Jominy curve. The minimum content of 0.19% is further justified by the core hardness which can be achieved thereby after quenching. At more than 0.25%, there is a risk that the hardness will be too high to preserve the desirable machinability of the steel" (Specification at Page 8).

Additionally, the steel composition according to Badard discloses the manganese content to be between 1.0% and 1.60%, i.e., $1.0\% \leq Mn \leq 1.6\%$ (Abstract). It is noted that the manganese content required by claim 1 lies between 1.1% and 1.5%, i.e., $1.1\% \leq Mn \leq 1.55\%$. As such, claim 1 requires a narrower range than that disclosed by the Badard reference. Appellants note that the specification discloses the criticality of the narrower claimed range of $1.1\% \leq Mn \leq 1.55\%$ by stating:

> The manganese content thereof is between 1.1 and 1.5%. The minimum value is justified by the production of the desired Jominy curve in conjunction with the contents of the other elements. At more than 1.5%, there is the risk of the appearance of segregations and also banding during the annealing operations. Furthermore, such a high content would bring about excessive corrosion of the heat-resistant coating of the steel ladle during the production operation. It would not be desirable to further restrict this range of contents since producing the precise grade desired in the steelworks could be excessively difficult. The preferred range is from 1.2 to 1.5%, preferably from 1.21 to 1.45% (Specification at Pages 8 and 9).

Also, the steel composition according to Badard discloses the silicon content to be between 0.8% and 1.50%, i.e., $0.8\% \leq Si \leq 1.5\%$ (Abstract). It is noted that the silicon content required by claim 1 lies between 0.8% and 1.2%, i.e., $0.8\% \leq Si \leq 1.2\%$. As such, claim 1 requires a narrower range than that disclosed by the Badard reference. Appellants note that the specification discloses the criticality of the narrower claimed range of $0.8\% \leq Si \leq 1.2\%$ by stating:

> The silicon content thereof is between 0.8 and 1.2%. In this range, the desired shape of the Jominy curve can be produced in conjunction with the contents of the other elements. The minimum value of 0.8% is justified by the production of the desired core hardness, as well as by the limitation of the deviation of hardness between the surface and the core after carburising or carbonitriding. At more than 1.2%, there is a risk that excessive segregations will appear since silicon, though it segregates itself only slightly, tends to accentuate the segregation of other elements. There would also be an increased risk of oxidation during carburising or carbonitriding. The preferred range is from 0.85 to 1.20%, preferably from 0.85 to 1.10% (Specification at Page 9).

Further, the steel composition according to Badard discloses the chromium content to be between 0.4% and 1.6%, i.e., $0.4\% \leq Cr \leq 1.6\%$ (Abstract). It is noted that the chromium content required by claim 1 lies between 1% and 1.4%, i.e., $1\% \leq Cr \leq 1.4\%$. As such, claim 1 requires a narrower range than that disclosed by the Badard reference. Appellants note that the specification discloses the criticality of the narrower claimed range $1\% \leq Cr \leq 1.4\%$ by stating:

> "In this range...the desired shape of the Jominy curve can be produced. Furthermore, the minimum content of 1.00% allows a high level of core hardness to be produced. At more than 1.40%, the cost of production operation would be increased unnecessarily" (Specification at Page 10)

Additionally, the steel composition according to Badard discloses the molybdenum content to be between 0% and 0.30%, i.e., $0\% \leq Mo \leq 0.30\%$ (Abstract). It is noted that the molybdenum content required by claim 1 lies between 0.10% and 0.25%, i.e., $0.1\% \leq Mo \leq 0.25\%$. As such, claim 1 requires a narrower range than that disclosed by the Badard reference. Appellants note that the specification discloses the criticality of the narrower claimed range of $0.8\% \leq Mo \leq 1.2\%$ by stating:

> The molybdenum content thereof is between 0.10 and 0.25%. In this range, in conjunction with the contents of the other elements, the desired Jominy curve shape and core hardness are produced. The preferred range is from 0.11 to 0.25% (Specification at Page 10).

Still further, the steel composition according to Badard discloses the aluminium content to be between 0% and 0.06%, i.e., $0\% \leq Al \leq 0.06\%$ (Abstract), the niobium content to be between 0% and 0.05%, i.e., $0\% \leq Nb \leq 0.05\ \%$ (Abstract), and the nitrogen content to be between 0.007% and 0.025%, i.e., $0.007\% \leq N \leq 0.025\%$ (Claim 3). It is noted that while there is some overlap between the ranges of Al, Nb, and N as taught by Badard, claim 1 generally requires precise ranges of Al, Nb, and N that are not disclosed by Badard. Appellants note that the specification discloses the criticality of the claimed Al, Nb, and N ranges taken together by stating:

> "The aluminium, niobium and nitrogen contents thereof must be controlled within precise limits. These are elements which, when interacting, bring about control of the fineness of the metal grain. This fineness is desirable in order to produce a high level of strength in the carburised or carbonitrided layer, a high level of fatigue strength and a reduction of the dispersion of the deformation during quenching. Furthermore, it is also important for producing the desired shape for the Jominy curve. Controlling the grain size is, in the context of the invention, all the more important since the steel must be capable of being subjected to a carburising or carbonitriding operation at high temperature without an excessive increase in the grain size occurring.
>
> This control of the grain is carried out substantially by means of precipitation of aluminium and/or niobium nitrides and carbonitrides. In order to produce this control, a significant presence of these two elements is therefore required, as well

as nitrogen at a content which is substantially higher than that which is generally produced following a production operation carried out under normal conditions.

The aluminium content must be between 0.010 and 0.045%. In addition to its grain control function mentioned above, this element controls the deoxidisation of the steel and the purity thereof in terms of inclusions of oxides. At less than 0.010%, the effects thereof, from the above perspectives, would be insufficient. At more than 0.045%, the purity in terms of inclusions of oxides risks being insufficient for the applications which are primarily intended. The preferred range is from 0.010 to 0.035%.

The niobium content must be between 0.010 and 0.045%. At less than 0.010%, the effect of grain control would not be sufficient, in particular for the lowest contents of aluminium. At more than 0.045%, there is a risk of cracks appearing during the continuous casting of the steel, in particular if interaction with the phosphorus can occur, as has been indicated above. The preferred range is from 0.015 to 0.045%, preferably from 0.015 to 0.040%.

In conjunction with the contents of aluminium and niobium as mentioned, the nitrogen content must be between 0.0130 and 0.0300% (130 to 300ppm) so that the desired adjustment of the grain size and shape of the Jominy curve are produced. The preferred range is from 0.0130 to 0.0220%" (Specification at Pages 10-12).

In view of the above-cited portions of the specification, Appellants note that the specification itself clearly indicates that the contents of Al, Nb, and N must be considered together and are equally important. In contrast, Appellants note that in the working samples disclosed by Badard, weight percentages of Al, Nb, and N are not defined but only mentioned as being less than a given weight percentage with no defined lower range or with a lower range of 0% (*See* Badard Table 1, Table 3, and claim 1). As such, Appellants respectfully submit that Badard does not view effects achieved by the combination of Al, Nb, and N to be critical since Badard does not view the presence of Al, Nb, and N to be compulsory.

In view of the above, Appellants respectfully submit that the above-noted portions of the specification clearly describe the criticality of the ranges of the presently claimed invention in order to produce the unexpected result of a Jominy curve with no significant inflection point. As such, it is respectfully submitted that the above-noted portions of the specification sufficiently detail the criticality of the narrower claimed ranges relative to the cited Badard reference.

(ii) Comparative Examples Described in the Specification and Illustrated in Figure 1

Further, Appellants respectfully submit that the specification of the present invention details the comparison of inventive steels (i.e., inventive steels E, F, and G), which contain a composition of elements inside the presently claimed range, and reference steels (i.e., reference steels A, B, C, and D) which contain a composition of elements outside the presently claimed range (*See* specification at pages 13-23 and Figure 1). Appellants respectfully submit that the comparison of the inventive steels and the references steels sufficiently provides a number of tests both inside and outside the claimed range to show the criticality of the claimed range.

In this regard, Appellants note that Figure 1 illustrates that Jominy curves corresponding to the inventive steel samples inside the claimed range (i.e., curves E, F, and G) lack a significantly marked inflection point in contrast to Jominy curves corresponding to the reference steel samples outside the claimed range (i.e., curves A, B, C, and D). Appellants stress that the curves corresponding to the samples inside the claimed ranges are straighter and less steep, thereby indicating that the hardness is less dependent on the depth at which it is measured.

Additionally, while curves E, F, and G may have a slight point of inflection, Appellants note that page 14 of the specification states that curves E, F, and G are defined as having no marked points of inflection. As such, it is apparent that the specification indicates that the inventive steel compositions corresponding to curves E, F, and G are to be interpreted as having no points of inflection.

Further, it is noted that page 6 of the specification states that a composition of steel which produces a Jominy curve with no inflection point is advantageous for greatly reducing deformations during a quenching operation following a carburizing operation. Therefore, in view of pages 6 and 14 of the specification, the inventive samples corresponding to curves E, F, and G greatly reduce deformation during a quenching operation following a carburizing operation relative to the reference steel samples corresponding to curves A, B, C, and D.

Additionally, Appellants note that among the reference steels tested and compared to the steels of the present invention, reference steels C and D have compositions that fall into the

ranges disclosed by Badard but outside the ranges disclosed by the present invention; most notably reference steels C and D contain amounts of chromium and nitrogen outside the claimed steel range (Specification at Page 13). Appellants note that the specification indicates that reference steels C and D both produce Jominy curves with marked inflection points due to insufficient contents of chromium and nitrogen (*See* Specification at Page14).

As stated above, a composition of steel which produces a Jominy curve with no marked inflection point is advantageous for producing greatly reduced deformations during the quenching operation following a carburizing or carbonitriding operation. Thus, Appellants respectfully submit that the differences between references steels A, B, C, and D and inventive steels E, F, and G, both apparent from the replacement sheet for Figure 1 and the corresponding description in the specification, clearly show that the claimed ranges of the presently claimed invention are critical to producing the unexpected result of a Jominy curves with no marked point of inflection. Accordingly, it is respectfully submitted that the above-noted portions of the specification and Figure 1 sufficiently detail a sufficient number of tests both inside and outside the claimed range in order to establish the criticality of the narrower claimed ranges relative to the cited Badard reference.

(iii) Declaration under 37 CFR 1.132

Appellants note that a Declaration under 37 CFR 1.132 was provided with the After-Final Amendment filed on February 12, 2010 and subsequently entered via the filing of the Request for Continued Examination of March 11, 2010. Appellants note that the Declaration provides additional evidence relating to the patentability of the presently claimed invention over the cited Badard reference by further describing the influence and effect of the Jominy curve in relation to the properties of steel composition based on heat treatments performed on reference steel A and inventive steel E as described in the specification of the present application. As such, it is respectfully requested that the content of the declaration be thoroughly considered in assessing the patentability of the presently claimed invention.

(iv) Closest Prior Art As Defined By The Examiner

On page 6 of the Office Action dated July 23, 2010, the Examiner has taken the position that the Appellants have failed to demonstrate that the presently claimed subject matter produces the alleged unexpected results in comparison to the closest prior art. In particular, the Examiner has taken the position that the steel composition disclosed in Table 3 of Badard in view of claim 3 of Badard presents prior art closer to any of the reference steels disclosed in the specification of the present application. Appellants respectfully disagree.

In this regard, Appellants note that Table 3 of Badard discloses a composition of elements as follows: 0.23 wt% of C; 1.32 wt% of Mn; 0.95 wt% of Si; 1.11 wt% of Cr; 0.10 wt% of Mo; 0.032 wt% of S; and 0.016 wt% of P. It is noted that Table 3 of Badard does not define weight percentages of elements Al, Nb, and N used in the inventive samples of Badard. However, claim 3 of Badard defines these ranges as: 0.008 - 0.05 wt% of Al; 0.02 - 0.05 wt % Nb; and 0.007 - 0.025 wt% N. As such, Appellants note that the closest prior art, as defined by the Examiner, does not provide weight percentages of elements Al, Nb, and N that are surely within the ranges required by claim 1 (i.e., instant claim 1 requires 0.010 - 0.045 wt % Al; 0.010 - 0.045 wt % Nb; and 0.013 - 0.030 wt % N).

Appellants note that the specification clearly states, in multiple locations, that the presence of Al, Nb, and N within the narrowly defined ranges is very important for controlling grain size, and in particular, very important during the carburization step which precedes the quenching (*See* at least pages 10-12 of the Specification stating, for example, "[t]he aluminum, niobium, and nitrogen contents thereof must be controlled within precise limits.").

As such, Appellants respectfully submit that Table 3 of Badard in view of claim 3 of Badard does not provide working example closer to the claimed invention than that of the reference steels disclosed in the specification because (i) Table 3 of Badard in view of claim 3 of Badard does not provide a working example with defined weight compositions of Al, Nb, and N and (ii) the specification defines the importance of the presence of Al, Nb, and N on the resulting Jominy curve. Therefore, Appellants respectfully submit that it cannot be definitely stated that

Table 3 of Badard in view of claim 3 of Badard is the closest prior art example due to lack of a working sample defining the weight percentage of critical elements Al, Nb, and N.

Appellants note that MPEP 716.02(e) allows an applicant to rebut a prima facie case of obviousness by comparing the claimed invention with samples more closely related to the invention than the prior art relied upon by the Examiner. Appellants respectfully submit that since the reference steels disclosed in the specification of the present application present working examples defining weight percentages of the all the claimed ranges of claim 1, the comparative examples disclosed in the specification are more closely related to the invention than Table 3 of Badard in view of claim 3 of Badard. Accordingly, Appellants respectfully submit that, because it has previously demonstrated above that the inventive samples according to the ranges of claim 1 achieve unexpected results over the reference steels disclosed in the specification of the present application, it has been sufficiently demonstrated that the presently claimed invention achieves unexpected results relative to the cited Badard reference.

Further, even assuming for the sake of argument that Table 3 of Badard in view of claim 3 of Badard is the closest prior art example, Appellants respectfully submit that it can be demonstrated that the presently claimed invention achieves unexpected results over the closest prior art example as defined by the Examiner based on the similarities between the closest prior art as defined by the Examiner and the reference steels disclosed in the specification.

In this regard, Appellants respectfully submit that based on the above-noted specification described influences of Al, Nb, and N on the shape of the Jominy curve, a Jominy curve for the closest prior art as defined by Examiner would be <u>not</u> rectilinear or at the very least would have a significantly marked inflection point. As such, Appellants note that the closest prior art example as defined by the Examiner would result in excessive deformations of the steel during quenching in contrast to the unexpected results of the presently claimed invention.

Appellants respectfully submit the above assertion is supported by the specification as originally filed in which reference steel D has a composition very similar to what is required by claim 1 of the instant application. In this regard, Appellants note the differences between

reference steel sample D and the presently claimed invention is that the Cr content of the reference steel sample D is slightly lower than that required by claim 1 (0.98% and at least 1%, respectively), and that the N content of reference steel D is lower than that required by claim 1 (0.09% and 0.013 - 0.030%, respectively). However, Appellants note that the 0.09% N is within the range required by claim 3 of Badard, and as such, is within the range required by the closest prior art as defined by the Examiner.

Appellants note that reference steel D has a Jominy curve with a significant marked inflection point at a depth of about 6-7 mm, and that the specification attributes the marked point of inflection to, in part, the insufficient content of nitrogen. As such, Appellants respectfully submit that this clearly shows that the N content is fundamental to the presently claim invention, and as such, the narrowly and precisely defined range of N, according to claim 1, is critical to the unexpected results of the presently claimed invention.

In view of the above, Appellants note that the criticality of the claimed ranges of Al, Nb, and N is clear from the specification, and that in view of the broad defined ranges of Al, Nb, and N of the closest prior art cited by the Examiner, Appellants respectfully submit that the closest prior art cited by the Examiner cannot achieve the unexpected results of the presently claimed invention.

Further, Appellants respectfully submit that the contents of Al, Nb, and N must be considered not only together, but also in combination with the other elements present in the claimed steel composition. In this regard, Appellants note that, as a whole, the elements that make up the presently claimed steel composition must be carefully balanced in order to obtain a composition of steel having the above described unexpected mechanical properties and desired Jominy curve shape.

Therefore, it is respectfully submitted that the presently claimed invention achieves unexpected results relative to the closest prior art as defined by the Examiner, in addition to the reference steels disclosed in the specification of the present application.

3. Unexpected Results are Commensurate in Scope with the Presently Claimed Invention

Appellants note that on pages 6 and 7 of the Office Action dated July 23, 2010, the Examiner indicates that all the reference steels (i.e., reference steels A, B, C, and D) have alloy composition ranges lower than those recited by claim 1, and that "to demonstrate that the purported unexpected results occur over the entire range of claim 1, comparative examples having alloying elements present in amounts greater than claimed are needed to establish that the unexpected results apply to the upper limits of the claimed ranges of instant claim 1."

Appellants note that while MPEP 716.02(d) requires that the showing of unexpected results be reviewed to see if the results occur over the entire claimed range, MPEP 716.02(b)(III) indicates that evidence of unexpected properties may be in the form of a direct or indirect comparison of the claimed invention with the closest prior art.

Appellants note that while the specification does not disclose comparative steel samples having alloying elements present in amounts greater than claimed, the specification teaches that samples having alloying elements present in amounts greater than claimed would not achieve the results of the presently claimed invention, and therefore, Appellants respectfully submit that reference steels having alloying elements present in amounts greater than claimed are not needed to illustrate the unexpected results of the presently claimed invention.

In this regard, Appellants note that at pages 8-12 of the specification as originally filed, the specification provides sufficient detail concerning the upper limits of the alloying elements in the presently claimed invention. For example, the specification indicates the following:

-with more than 0.25% of C, the steel would not be easily machinable as a result of the steel being too hard;

-with more than 1.25% of Mn, segregations would appear during the annealing, and, the liquid steel would excessively corrode the refractory coating of the ladle containing liquid steel;

-with more than 1.2% of Si, the segregations and the risks of oxidation during carburization would increase;

- with more than 0.01% of S, the hot forgeability would be lowered;

- with more than 0.025% of P, the upper limits set by the standards ruling the steel grades(to which the steel of the invention belongs) would be exceeded, and the interaction with Nb would make the tool too brittle;

- at more than 1.40% of Cr the cost of the steel would be needlessly increased;

- at more than 0.3% of Cu, the ductility and the core strength would be lowered;

- at more than 0.45% of Al, the oxide inclusions would be too numerous; and

- at more than 0.045% of Nb, there would be a risk of cracking due to an interaction with P.

In view of the above, Appellants note that the motivation for the choices for the upper limits of the alloying elements are not linked to the obtaining of a Jominy curve with a gentle slope and no significant marked inflection point, but that the choices for the upper limits of the alloying elements are based on classical metallurgical motivations.

As such, Appellants note that the upper limits are chosen for reasons which are not specifically related to the problem solved by the invention, and thus, Appellants respectfully submit that reference steels having alloying elements present in amounts greater than claimed are not necessary for illustrating the unexpected results of the presently claimed invention since the above-noted motivation of choosing the upper limits of claimed range provide an indirect comparison to conventional steel compositions.

Therefore, Appellants respectfully submit that (i) because unexpected results of the presently claimed invention have been sufficiently demonstrated at the lower end of the claimed range and (ii) because the upper end of the claimed range is defined by considerations entirely separate than those defining the lower end of the claimed range, unexpected results commensurate with the scope of the claim need only be directly shown at the lower end of the claimed range.

In view of the above, Appellants respectfully submit that it has been clearly shown that the presently claimed invention produces unexpected results relative to the cited Badard reference. Accordingly, claim 1 is patentable over Badard.

Further, claims 2-4 are patentable over Badard based at least on their dependency from allowable claim 1.

II. Conclusion

For the reasons set forth above, Appellants respectfully submit that claims 1-4 are clearly allowable over the prior art of record.

Respectfully submitted,

Pascal DAGUIER et al.

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CLAIMS APPENDIX - claims on appeal

1. Steel for mechanical components, wherein the composition thereof is, in percentages by weight:

- $0.19\% \leq C \leq 0.25\%$;

- $1.1\% \leq Mn \leq 1.5\%$;

- $0.8\% \leq Si \leq 1.2\%$;

- $0.01\% \leq S \leq 0.09\%$;

- trace levels $\leq P \leq 0.025\%$;

- trace levels $\leq Ni \leq 0.25\%$;

- $1\% \leq Cr \leq 1.4\%$;

- $0.10\% \leq Mo \leq 0.25\%$;

- trace levels $\leq Cu \leq 0.30\%$;

- $0.010\% \leq Al \leq 0.045\%$;

- $0.010\% \leq Nb \leq 0.045\%$;

- $0.0130\% \leq N \leq 0.0300\%$;

- optionally trace levels $\leq Bi \leq 0.10\%$ and/or trace levels $\leq Pb \leq 0.12\%$ and/or trace levels $\leq Te \leq 0.015\%$ and/or trace levels $\leq Se \leq 0.030\%$ and/or trace levels $\leq Ca \leq 0.0050\%$;

the balance being iron and impurities resulting from the production operation, the chemical composition being adjusted so that mean values J_{3m}, J_{11m}, J_{15m} and J_{25m} for five Jominy tests are such that:

$\alpha = | J_{11m} - J_{3m} \times 14/22 - J_{25m} \times 8/22 | \leq 2.5$ HRC; and

$\beta = J_{3m} - J_{15m} \leq 9$ HRC.

2. Steel for mechanical components according to claim 1, wherein the composition thereof is adjusted so that

$$ß = J_{3m} - J_{15m} \leq 8 \text{ HRC}.$$

3. Steel for mechanical components according to claim 1, wherein the composition thereof is:

- $0.19\% \leq C \leq 0.25\%$;
- $1.2\% \leq Mn \leq 1.5\%$;
- $0.85\% \leq Si \leq 1.2\%$;
- $0.01\% \leq S \leq 0.09\%$;
- trace levels $\leq P \leq 0.025\%$;
- $0.08\% \leq Ni \leq 0.25\%$;
- $1.1\% \leq Cr \leq 1.4\%$;
- $0.10\% \leq Mo \leq 0.25\%$;
- $0.06\% \leq Cu \leq 0.30\%$;
- $0.010\% \leq Al \leq 0.045\%$;
- $0.015\% \leq Nb \leq 0.045\%$;
- $0.0130\% \leq N \leq 0.0300\%$;
- optionally trace levels $\leq Bi \leq 0.07\%$ and/or trace levels $\leq Pb \leq 0.12\%$ and/or trace levels $\leq Te \leq 0.010\%$ and/or trace levels $\leq Se \leq 0.020\%$ and/or trace levels $\leq Ca \leq 0.045\%$, the balance being iron and impurities resulting from the production operation.

4. Steel for mechanical components according to claim 3, wherein the composition thereof is:

- $0.20\% \leq C \leq 0.25\%$;
- $1.21\% \leq Mn \leq 1.45\%$;
- $0.85\% \leq Si \leq 1.10\%$;
- $0.01\% \leq S \leq 0.08\%$;
- trace levels $\leq P \leq 0.020\%$;
- $0.08\% \leq Ni \leq 0.20\%$;
- $1.10\% \leq Cr \leq 1.40\%$;
- $0.11\% \leq Mo \leq 0.25\%$;
- $0.08\% \leq Cu \leq 0.30\%$;
- $0.010\% \leq Al \leq 0.035\%$;
- $0.025\% \leq Nb \leq 0.040\%$;
- $0.0130\% \leq N \leq 0.0220\%$;
- optionally trace levels $\leq Bi \leq 0.07\%$ and/or trace levels $\leq Pb \leq 0.12\%$ and/or trace levels $\leq Te \leq 0.010\%$ and/or trace levels $\leq Se \leq 0.020\%$ and/or trace levels $\leq Ca \leq 0.045\%$, the balance being iron and impurities resulting from the production operation.

EVIDENCE APPENDIX

1. Declaration Under 37 CFR 1.132 of Pascal Daguier, filed with Appellant's response of February 12, 2010 and entered via the filing of an RCE on March 11, 2010.

RELATED PROCEEDINGS APPENDIX

None.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	**Confirmation No. 2691**
Pascal DAGUIER et al.	:	Attorney Docket No. 2006_1570A
Serial No. 10/593,463	:	Group Art Unit 1793
Filed September 19, 2006	:	Examiner Mark L. Shevin
STEEL FOR MECHANICAL PARTS, METHOD FOR PRODUCING MECHANICAL PARTS FROM SAID STEEL AND THE THUS OBTAINABLE MECHANICAL PARTS	:	**Mail Stop: AF**

DECLARATION UNDER RULE 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants herein provide a declaration under Rule 1.132. Applicants respectfully submit that the declaration, signed by one of the inventors in the present application, presents additional evidence for the patentability of the present application. Applicants respectfully request that the content of the declaration be thoroughly considered in assessing the patentability of the present application.

Respectfully submitted,

Pascal DAGUIER et al.

/Stephen W. Kopchik/
2010.02.12 12:25:46 -05'00'

By: _____
Stephen W. Kopchik
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February 12, 2010

ASCOMETALCREAS

DECLARATION FROM AN INVENTOR TO THE USPTO

Re : US Patent Application 10/593,463 Hagondange, January 19th, 2010

Dear Sirs,

We ask you, by the present letter, to consider the following remarks :

The drawing of the application is wrong : the letters assigned to the curves do not correspond to the letters of the samples on table 1.

Reference sample A on table 1 corresponds to curve G of the drawing
Reference sample B on table 1 corresponds to curve F of the drawing
Reference sample C on table 1 corresponds to curve C of the drawing
Reference sample D on table 1 corresponds to curve D of the drawing
Sample E according to the invention corresponds to curve A of the drawing
Sample F according to the invention corresponds to curve B of the drawing
Sample G according to the invention corresponds to curve E of the drawing

Taking into account this first remark, the text of the application is more understandable and it appears clearly that the Jominy curves of the steels of the invention are flattest than those of the reference steels, deprived of any inflexion point.

To illustrate the effect of the Jominy curves on the steel properties, we conducted heat treatments on gear shafts in order to measure the residual deformation after heat treatment (carburizing under low pressure and gas quenching) of the steel of the invention E and of the reference steel A.

The illustration given in the added figure shows that the steel of the invention E allows to obtain, after heat tretment, a residual deformation less pronounced and less scaterred than the reference steel A when heat treated in the same conditions. The residual deformation lies between 0 and 40 µm while for the reference steel, the measured deformation lies between 0 and 100 µm. Softer quenching (oil quenching), did not allow to minimise the residual deformation of the reference steel as it was obtained with the invention steel under hard quenching conditions. The influence of the Jominy curve (the chemical composition needed to obtain such a Jominy curve) is real and measurable. This added argument shows that the concept explained in EP 0890653 is applicable in these examples, modified by the chemical composition explained in the different claims of the application.

We are aware that false statements from our parts would expose us to legal procedure. Considering this, we would be very pleased if you could re-examine the content of this application, in view of above statements.

Yours faithfully.

Pascal DAGUIER

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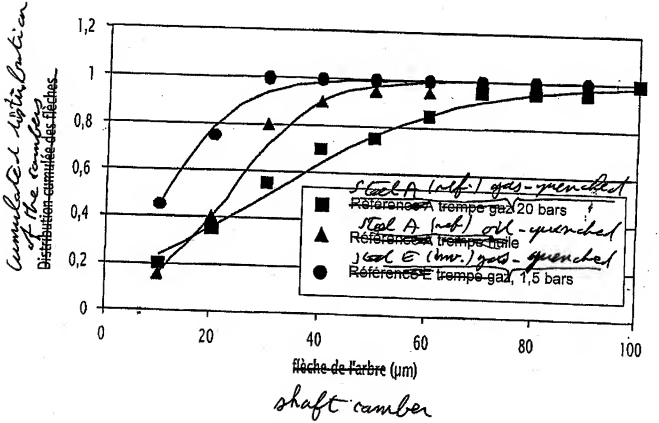
Distribution cumulée des flèches
cumulative distribution of the camber
1,2
1
0,8
0,6
0,4
0,2
0
0
20
40
60
80
100
flèche de l'arbre (µm)
shaft camber
Référence A trempe gaz 20 bars
Référence A trempe huile
Référence E trempe gaz, 1,5 bars